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Proposed Plan for the Environmental Restoration Disposal Facility at Hanford, Richland, Washington

United States
Department of Energy
Richland, Washington

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Draft A

Proposed Plan for the Environmental Restoration Disposal Facility at Hanford, Richland, Washington

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United States
Department of Energy
P.O. Box 550
Richland, Washington 99352

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PROPOSED PLAN FOR THE ENVIRONMENTAL RESTORATION DISPOSAL FACILITY (ERDF) AT HANFORD, RICHLAND, WASHINGTON

U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON DEPARTMENT OF ECOLOGY
U.S. DEPARTMENT OF ENERGY

JUNE 1994

INTRODUCTION

The U.S. Department of Energy's (DOE) Hanford Facility near Richland, Washington has been operated by the Federal Government since 1943 for plutonium production and nuclear energy research and development. Past activities released waste to the environment that contaminated soil and groundwater with *hazardous/dangerous waste*[a], and radioactive contaminants.

The remedy selection process for remediation of operable units located along the Columbia River is scheduled to commence in the fall of 1994 (see box). Based on significant public participation to date, it is anticipated that the remedies selected for these operable units may include removal of waste near the Columbia River and isolation of the waste in a central location. The purpose of this proposed action is to support the removal of contaminants from portions of the Hanford Site (including near the Columbia River) in a timely manner to allow those remediated portions of the Site to be released for other productive uses.

> **Regulatory Framework**
> In 1989, the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement) was signed by the U.S. Environmental Protection Agency (EPA), Washington Department of Ecology (Ecology), and the U.S. Department of Energy (DOE) to provide for cleanup of contaminated areas. The Tri-Party Agreement includes an Action Plan which provides the overall plan and schedule for investigation and remediation of the Hanford Site. The agreement designated contaminated areas, known as operable units, as either *Resource Conservation and Recovery Act* (RCRA) past practice units or *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) past practice units. The Fourth Amendment to the Tri-Party Agreement was made in January of 1994.

This proposed plan (plan) identifies the proposed alternative for placement of remediation waste generated during remediation of CERCLA and RCRA past practice sites on the Hanford Site. Except for the no-action alternative, all of the alternatives evaluated in this plan include a RCRA Corrective Action Management Unit (CAMU) called the Environmental Restoration Disposal Facility (ERDF). ERDF would serve as the receiving

[a]Words in italics are defined in the glossary.

facility for most of the treated and untreated waste excavated during remediation of CERCLA and RCRA past-practice sites. The primary element of the ERDF is a single trench excavated below existing grade that will be filled with remediation waste and closed with a protective surface barrier. Supporting facilities, such as administrative buildings, railroad spurs, waste off-loading and transport equipment, decontamination facilities, etc., will also be included as part of the ERDF. In accordance with the CAMU regulations (40 CFR 264.552), only remediation waste that originates within the Hanford Site may be placed in the ERDF. The waste is expected to consist of *dangerous/hazardous waste*, PCB and asbestos waste, low-level radioactive waste, and mixed waste (containing both dangerous and radioactive waste).

This plan summarizes information presented in the Remedial Investigation and Feasibility Study (RI/FS) Report for the Environmental Restoration Disposal Facility - Rev. 0 (DOE/RL-94-99). This plan and the RI/FS report are part of a regulatory package for the ERDF that includes an application for designation of the ERDF as a CAMU and a National Environmental Policy Act (NEPA) roadmap document. RCRA CAMU requirements are addressed in the CAMU application. NEPA values are addressed within the RI/FS and the CAMU application as described in the NEPA roadmap document. These and other documents that support this proposed plan are available in the Administrative Record (see box).

Administrative Record

The public is encouraged to review this document and all information used in the evaluation of the ERDF. The Administrative Record file, which contains the information used in selection of the proposed design, is available in the following locations:

U.S. Department of Energy Richland Operations
Administrative Record Center
2440 Stevens Center Place
Richland, WA 99352

EPA Region 10
Superfund Record Center
1200 Sixth Ave.
Park Place Building, 7th floor
Mail Stop: HW-074
Seattle, WA 98101

Washington Department of Ecology
Administrative Record
719 Sleater-Kinney Road SE
Capital Financial Building, Suite 200
Lacey, WA 98503-1138

This plan is intended to facilitate public participation in design and construction of the ERDF and is consistent with Section 117(a) of CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA). The remedial alternative will be selected in accordance with CERCLA, after the public comment period has ended and all comments have been reviewed and considered. It is important for the public to recognize that the proposed remedy is a preliminary recommendation. The proposed alternative may be subject to modification or possible rejection based on public comments. Therefore, the public is encouraged to consider all of the alternatives outlined in this plan and described in more detail in the RI/FS document. The 45-day public comment period is scheduled from ??? through ???, 1994. Comments should be sent to:

U.S. Environmental Protection Agency
Attn: Pamela Innis
712 Swift Blvd., Suite 5
Richland, WA 99352
(509) 376-4919

BACKGROUND

ERDF Location. As shown on Figure 1, the ERDF site is located between the 200 West and 200 East Areas extending east of the 200 West Area. The site will cover 4 square kilometers (1.6 square miles) on the 200 area plateau at an elevation of 205 to 230 m (670 to 750 ft). The topography of the site is shown on Figure 2. Placement of the ERDF on the 200 Area plateau will allow consolidation of waste away from the Columbia River at a higher ground surface elevation (with a corresponding greater depth to groundwater). The site was selected based on information and analysis presented in the Siting Evaluation Report (available in the Administrative Record).

No waste units are located within the ERDF boundaries. However, contaminated groundwater related to discharge of chemical processing wastewater in the 200 West Area has migrated beneath the ERDF site. Contaminants present in groundwater at the site are: tritium, iodine 129, technetium 99, gross alpha, gross beta, chloroform, nitrate, chromium and carbon tetrachloride. The highest concentrations of contaminants are generally found at the points nearest the 200 West Area; that is, at the west end of the ERDF. Remediation of these plumes will be addressed in the RI/FS process for the 200 Area operable units. Siting of the ERDF will not prohibit remediation of these plumes.

Hydrogeology. The groundwater elevation beneath the ERDF site ranges from 138 to 126 m (450 to 410 ft) and the depth to groundwater beneath the ERDF site ranges from 70 to 100 m (230 to 330 ft). Assuming that the ERDF trench will extend approximately 20 m (70 ft) beneath the ground surface, the depth to groundwater beneath the waste will range from 50 to 80 m (160 to 260 ft). The uppermost aquifer (water-bearing geologic formation) beneath the ERDF site is located within permeable sand and gravel soils and generally has a saturated thickness ranging from 20 to 70 m (70 to 230 ft). Groundwater beneath the site generally flows from west to east and groundwater discharge is ultimately to the Columbia River.

Cultural Resources. The Hanford Cultural Resources Laboratory (HCRL) conducted a cultural resources survey at and surrounding the ERDF site during the summer of 1993. The survey identified two Native American archaeological sites, two Euro-American archaeological sites, one site with tooth enamel, and nine isolated artifacts. One isolated artifact (a cobble tool) was also identified during a previous survey. None of the sites were considered eligible for the National Register. However, HCRL stated that the Euro-American archeological sites may represent part of the greater Euro-American ranching community in Southeast Washington State and may be considered regionally or locally significant viewed in this context. The two Euro-American sites are located outside the boundaries of the area impacted by ERDF.

Ecological Resources. Ecological surveys of the ERDF site have found it to be undisturbed shrub-steppe habitat that has not sustained significant fire damage. The surveys identified long-billed curlews, sage sparrows, and loggerhead shrikes as nesting in the area. Grasshopper sparrows were present and possibly nesting at the site. Swainson's hawks were observed hunting in the area. Burrowing owls, while not observed during the surveys, have been seen at the site in the past and are presumed to currently inhabit the area.

Mature shrub-steppe provides important habitat for several plant and animal species of concern that depend on the shrub component, usually sagebrush, for nesting, food and protection. Bitterbrush shrubs provide browse for a resident herd of wild mule deer. Certain birds rely on sagebrush or bitterbrush for nesting (i.e., sage sparrow, sage thrasher, and loggerhead shrike). Loggerhead shrikes are year-round residents that are present at low densities. Sage sparrows are common summer residents of the Hanford Site that are restricted almost entirely to sagebrush stands. Mature shrub-steppe habitat also provides prime foraging habitat for a variety of raptor (bird of prey) species (e.g., the Swainson's hawk). Shrub-steppe habitat available for species of concern on the Hanford Site may become a more critical issue as agricultural, industrial and urban development decreases the amount of this habitat type in eastern Washington.

The remaining undisturbed shrub-steppe habitat at the Hanford Site is considered priority habitat by the State of Washington due to its relative scarcity and its importance as nesting, breeding and foraging habitat for *sensitive species*. No plants or mammals on the federal list of Endangered and Threatened Wildlife and Plants are known to reside or occur on the ERDF site, although several candidate species are known to occur. DOE (in cooperation with the State of Washington Department of Fish and Wildlife and the U.S. Fish and Wildlife Service) is currently developing a biological resources management plan to address potential ecological impacts from remediation activities.

Expected Waste Characteristics. It is anticipated that the ERDF will receive waste from the 100, 200, and 300 Areas. The summary provided below is based on information contained in the Limited Field Investigation Reports for the 100 Area, the remedial investigation reports for the 300 Area, and the Aggregate Area Management Study reports for the 200 Area. (These reports are found in the Administrative Record.) The total volume of waste is expected to be less than 21.4 million m^3 (28 million yd^3) and is expected to consist of the following: contaminated soil and demolition debris associated with process wastewater disposal units and unplanned releases (approximately 65-75%); burial ground waste (approximately 15-20%); and wastewater pipelines, ancillary equipment, and associated soil contamination (approximately 10-15%). Waste generating activities and *waste units* for each area are discussed below:

The 100 Area includes nine water-cooled, plutonium production reactors that were built along the shore of the Columbia River upstream from the abandoned town of Hanford. Waste units in the 100 Area include cooling water retention basins, pipelines, river outfall structures, subsurface process water disposal units (e.g., french drains), *solid waste* burial grounds, and unplanned releases (i.e., spills). 100 Area waste includes soil, sediments, sludges, burial ground waste, and demolition debris (e.g., pipe and concrete).

Historically, the 200 Area was used for nuclear fuel reprocessing, plutonium recovery, and waste management and disposal. Although highly radioactive liquid wastes were discharged to numerous subsurface disposal units in the 200 Area, the resulting high-activity contaminated soils are not considered likely waste materials for the ERDF. Waste units where remediation may result in placement of materials in the ERDF include 24 migration sites (consisting of surface soils contaminated by spills or wind-blown dispersion of radioactive materials) and an extensive network of pipelines and ancillary equipment with associated soil contamination.

Activities in the 300 Area have been related primarily to the fabrication of nuclear fuel elements. In addition, technical support, service support, and research and development (R&D) activities related to fuel fabrication and reactor testing were conducted. Current R&D activities focus on peaceful uses of plutonium, liquid metal technology, fast-flux test facility support, gas-cooled reactor development, life science research, and Tri-Party Agreement support. Waste units in the 300 Area include unplanned releases, process sewer piping, process sewer ponds and trenches, and burial grounds.

Potential Risks Associated with the 100 and 300 Areas. Risk assessments have been completed for some operable units in the 100 and 300 Areas. These risk assessments evaluate risks associated with potential future land use scenarios and do not reflect current risks (which are nonexistent due to current access controls). Based on the qualitative risk assessments completed to date, the incremental cancer risks (ICRs, see box) exceed 1×10^{-2} for both residential and recreational land use in some waste units in the 100 Area. Non-carcinogenic risks are measured in terms of hazard quotients (HQ, see box). Hazard quotients for some waste units in the 100 Area exceed 1 for the residential land use scenario. The ICRs associated with industrial land use in the 300 Area operable units are as high as 3×10^{-3}. The HQs associated with 300 Area waste units investigated to date are less than 1 for industrial land use.

Incremental Cancer Risk (ICR) represents the additional cancer risk to a human receptor due to exposure to a carcinogenic (cancer-causing) contaminant. ICR is generally expressed in terms of the probability of cancer genesis, and is generally expressed in scientific notation. For example, an incremental cancer risk of 1×10^{-6} means that on average, 1 in a million human receptors will contract cancer. CERCLA has established that incremental cancer risks between 1×10^{-6} and 1×10^{-4} are acceptable and that risk below 10^{-6} are inconsequential.

Hazard Quotient (HQ) is a measure of non-carcinogenic risk and is expressed as the ratio of contaminant intake to a reference dose. The reference dose is the dose at which adverse health impacts are believed to occur. Therefore, HQs below 1 should not result in any adverse health impacts.

Results of the 100 and 300 Areas Feasibility Studies. Preliminary feasibility studies have been completed for the 100 and 300 Areas. These FSs have developed a variety of remediation alternatives that can achieve effective cleanup of the contaminated sites, including alternatives that rely on excavation and placement (either with or without treatment) in a 200 Area waste management unit.

OBJECTIVES

Remedial objectives were developed to focus the development, screening, and analysis of alternatives to ensure that they are protective of human health and the environment. Remedial objectives are based on a variety of factors, of which the primary drivers are applicable or relevant and appropriate requirements (ARARs, see box) and human and ecological health risks. The following objectives have been identified for the ERDF:

> **Definition of ARAR**
> Applicable or Relevant and Appropriate Requirements (ARARs) are federal and state requirements or laws other than CERCLA that a remedy must attain. Applicable requirements are cleanup standards that specifically address the site contaminants, location or remedial action. Relevant and appropriate requirements address problems or situations sufficiently similar to those encountered at the site.

1) **Support the timely removal of contaminants from portions of the Hanford Site (including near the Columbia River):** This is the overall objective of this action and is based on public opinion that contaminants should be removed from near the Columbia River as soon as possible. This opinion reflects concern regarding potential impacts of these contaminants on the Columbia River and the desire to release the remediated areas for other productive uses.

2) **Prevent unacceptable direct exposure to waste:** Direct exposure to the types of waste received at the ERDF, via external exposure, dermal contact, or ingestion, could result in unacceptable health risks to humans and biota. Preventing unacceptable exposure to wastes at the ERDF is important during operation of the facility (i.e., during waste transport and filling operations), and following closure. Once the ERDF is closed, direct exposure to waste is only possible if the surface barrier is breached.

3) **Prevent unacceptable contaminant releases to air:** Inhalation exposure to the types of waste received at the ERDF could result in unacceptable health risks. Similar to the direct exposure pathway, inhalation of waste could occur during operation of the ERDF. Once the ERDF is closed, air releases are only possible if the surface barrier is breached.

4) **Prevent contaminant releases to groundwater above ARARs and *health-based criteria*:** Migration of contaminants through the unsaturated zone to groundwater could result in unacceptable human exposure to contaminants hundreds to thousands of years in the future. Protecting groundwater beneath the ERDF also results in protecting the Columbia River.

5) **Minimize ecological impacts:** Construction of the ERDF will result in harmful impacts on the ecology of the ERDF site and the quarry sites providing materials for ERDF construction. Because significant value is attached to the ecology at these sites, ecological impacts will be minimized and/or mitigated.

SUMMARY OF ALTERNATIVES

The primary technologies evaluated in the RI/FS relate to the configuration and design of the ERDF waste containment unit, including geometry of the trench excavation, trench liners, and surface barriers. Technologies related to institutional controls, surface water management, dust control, and treatment of wastewater were also addressed. Only the remediation technologies that met the CERCLA criteria of effectiveness, implementability, and cost were retained.

The retained technologies were assembled into nine design alternatives (in addition to the no-action alternative). The nine alternatives represent combinations of three trench liner options with three surface barrier options. The purpose of the liner is to collect *leachate* generated due to precipitation percolating through the waste before the surface barrier is placed over the waste. The synthetic portions of the liners are not intended to last for more than several decades. The purpose of the surface barrier is to minimize the potential for intrusion into the waste and reduce or eliminate *infiltration* through the waste after closure.

The three trench liner options include no trench liner, a single composite liner (Figure 3), or a RCRA minimum technology requirements (MTR) double composite liner (Figure 4). The single composite liner consists of the following three primary units:

- Operations layer - clean fill 0.9 m (3 ft) thick, to protect the liner against damage from construction and waste placement equipment and against freezing in the exposed portions of the liner.

- Drainage layer - a drainage gravel layer covered by a geotextile separator to prevent silting of the gravel by the operations layer. The gravel layer directs infiltration percolating through the waste to a collection sump where it is pumped out of the trench. A geocomposite (a geonet sandwiched between layers of geotextile) is used instead of gravel on the side slopes of the trench.

- Low-*permeability* liner - a synthetic high-density polyethylene (HDPE) geomembrane over 0.3 m (1 ft) of compacted clay with permeability no greater than $1x10^{-9}$ m/s ($2.8x10^{-4}$ ft/day). Use of two liners provides redundant low permeability; the synthetic membrane protects the clay against desiccation, and the clay provides a thick liner capable of some self-healing with settling and other geological stresses. A geotextile cushion overlies the HDPE geomembrane to minimize damage during placement of the drainage layer.

The double composite liner is similar to the single liner except that it includes a secondary HDPE liner and leachate collection system directly beneath the primary HDPE liner. In addition, the thickness of the clay is increased from 0.3 m (0.9 ft) to 1.0 m (3 ft).

The surface barrier options include a low-infiltration soil barrier, a Hanford barrier, or a modified Hanford Barrier. The Hanford Barrier is shown in Figure 5 as an example. All three barriers are at least 4.6 m (15 ft) thick and include passive controls (such as surface and subsurface markers) to deter intrusion. Ongoing research in the area of barrier performance should provide additional information regarding relative performance of the barrier options. The barrier to be selected must ensure protectiveness of human health and the environment by limiting infiltration, deterring intrusion, and minimizing releases. However, since barrier construction will not commence for many years after operation of the

ERDF begins, selection of a barrier design will not be finalized in this proposed plan. Therefore, the ten alternatives are simplified to four alternatives, listed below:

- Alternative 1 - No Action
- Alternative 2 - ERDF with No Liner
- Alternative 3 - ERDF with a Single Composite Liner
- Alternative 4 - ERDF with a RCRA Double Composite Liner

Evaluation of the no-action alternative is required under CERCLA. The no-action alternative for this FS consists of not constructing a centralized repository on the Hanford Site to accommodate remediation waste from Hanford Site past-practice operable units. Implementation of the no-action alternative would result in the necessity for each operable unit to develop alternatives that utilize *in-situ treatment and/or containment*, or disposal facilities at the operable unit.

Alternatives 2, 3, and 4 include institutional controls, dust control, surface water management, wastewater treatment, a new rail spur to the ERDF, waste off-loading and transportation systems, buildings, a cement batch plant (for subsidence control), equipment for internal and external communications, emergency response equipment, and personnel protection. In addition, all of the alternatives (other than no-action) utilize a deep single-trench approximately 20 m (70 ft) deep and 300 m (1,000 ft) across. The maximum areal dimensions of the trench are shown on Figure 2 and a cross-section of the trench is shown in Figure 6. This trench configuration minimizes the footprint (areal extent) of the waste facility. The reduced footprint of the deep single-trench design offers the following advantages in comparison to other configurations:

- Less habitat disruption,
- Reduced material needs (thus, reduced ecological and cultural impact on borrow areas),
- Lower costs for the trench liner and surface barrier.

Using the deep single-trench configuration, the disturbed area of the ERDF, including the trench, roads, and supporting facilities, is estimated to be 2.6 km^2 (650 acres or 1.0 mi^2). The trench itself will fill approximately half of this area.

Alternatives 2, 3, and 4 include waste acceptance criteria consisting of acceptable soil and leachate concentrations, to protect human health and the environment. Acceptable soil and leachate concentrations were developed for the contaminants identified in potential waste from the 100, 200, and 300 Areas. For purposes of the detailed evaluation in the RI/FS report, it was assumed that only wastes would comply with the leachate criteria would be accepted.

EVALUATION OF ALTERNATIVES

The NCP provides nine criteria for detailed evaluation of alternatives. Brief descriptions of the criteria are provided in the box on this page. Because the no-action alternative does not satisfy the overall objective of this action to "support the timely removal of contaminants from portions of the Hanford Site (including near the Columbia River) to allow those remediated portions of the Site to be released for other productive uses" it is not evaluated further. Results of the detailed evaluation of alternatives for the remaining alternatives are summarized below:

1) Overall protection of human health and the environment: This criterion draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. As discussed below under these criteria, all the alternatives fulfill the objectives specified regarding long-term protection of human health and the environment while insuring protection of worker and public health during operations.

CERCLA Evaluation Criteria

1) Overall protection of human health and the environment: Alternatives shall be assessed to determine whether they can adequately protect human health and the environment, in both the short- and long-term, by eliminating, reducing, or controlling exposures. Overall protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

2) Compliance with ARARs: This criterion addressed whether or not a remedy will meet all of the ARARs of other (non CERCLA) federal and state environmental laws and/or provides justification for waivers (if necessary).

3) Long-term effectiveness and permanence: Alternatives shall be assessed for the long-term effectiveness and permanence they provide following implementation, along with the degree of certainty that the alternative will prove successful.

4) Reduction of toxicity, mobility, or volume through treatment: This criterion is evaluated based on the anticipated performance of any treatment technologies that may be employed in a remedy.

5) Short-term effectiveness: The short-term impacts of alternatives shall be assessed considering risks that might be posed to the community during implementation of an alternative, potential impacts on workers during remedial action, potential environmental impacts of the remedial action, and time until protection is achieved.

6) Implementability: The ease or difficulty of implementing the alternatives shall be assessed by considering technical difficulties and unknowns associated with the construction and operation of a technology, availability of services and materials, and administrative feasibility.

7) Cost: Costs that should be considered include capital costs, operation and maintenance (O&M) costs, and the *net present value* of capital and O&M costs.

8) State acceptance: Based on the state's review of the final RI/FS report and proposed plan, this criterion is assessed based on whether the state concurs with, opposes, or has no comment on the preferred alternative.

9) Community acceptance: Community acceptance will be assessed in the record of decision (ROD) following a review of the public comments received on the RI/FS report and the proposed plan.

2) Compliance with ARARs: The determinations provided in Chapter 7 for action and location-specific ARARs are valid for all the alternatives except the no-action alternative. In general, all the alternatives satisfy ARARs identified in Chapter 7. The only exception is the TSCA requirement that wastes with more than 50 ppm polychlorinated biphenols (PCBs) be disposed in a lined facility. In order to accept wastes with PCB concentrations greater than 50 mg/kg, Alternative 2 (no liner) would require a waiver under CERCLA. Alternatives 3 and 4 both include liners and no waiver would be required. The TSCA waiver request could be applied for based on the equivalent standard of performance criterion provided under CERCLA. Demonstration of equivalent standard of performance is justified by the analyses in Appendix A of the RI/FS for an unlined trench, indicating that PCBs would not impact groundwater beneath the ERDF.

The ERDF is proposed to be a Corrective Action Management Unit (CAMU). The CAMU rule provides flexibility for onsite management of remediation waste previously not available to facilities subject to RCRA. The CAMU regulations were created to promote

Evaluation of the CAMU Criteria

1) Facilitate reliable, effective, protective, and cost-effective remedies. The ERDF location is in an area remote from the Columbia River and the public with a thick unsaturated zone. Consolidation of contaminated materials at ERDF will be more reliable, effective and protective than either current conditions, capping the waste in place, in-situ treatment, or consolidation of the waste at many small sites near the river. Under the CAMU rule, waste characterization and treatment need not meet LDR standards. Without a CAMU, Hanford remediation waste may require excessive waste characterization and treatment (estimated to cost billions of dollars), without providing significant risk reduction.

2) Do not create unacceptable risks to humans or to the environment. Operation of ERDF as a CAMU will not pose long-term or short term risks to human health or the environment from exposure to hazardous or radioactive wastes (see CERCLA criteria 3 and 5).

3) Use uncontaminated areas only if it is more protective than management of waste at contaminated areas. Construction of ERDF in a surface contaminated area would pose greater risk to workers than construction at the proposed location. Preexisting groundwater contamination from upgradient sources is present below ERDF.

4) Manage and contain waste to minimize future releases. The ERDF will be capped with a protective barrier designed to limit infiltration, deter intrusion and minimize releases to the extent practicable. Consolidation of waste into a single ERDF unit will facilitate long-term monitoring and maintenance and minimize the risk of inadvertent intrusion and release of contaminants.

5) Expedite remedial activities. The ERDF CAMU provides a site and design for Hanford Facility remediation waste that is protective of human health and the environment. If multiple waste management facilities were used, many analyses would be required to demonstrate protectiveness. Operation of ERDF as a CAMU will allow flexibility in the time consuming and expensive processes of waste characterization and treatment, while protecting human health and the environment.

6) When appropriate, use treatment technologies to enhance long-term effectiveness. Treatment of waste will be undertaken based on evaluations and remedial decisions made at the source operable units. Waste that does not meet ERDF waste acceptance criteria will be treated.

7) Minimize the area containing waste after closure. The ERDF will consolidate Hanford Facility remediation waste in a single facility. The size of ERDF has been minimized to the extent practicable.

active remediation of contaminated sites, as opposed to capping in place. In the preamble to the CAMU Rule, EPA stated that the substantive CAMU Rule requirements will be applicable or relevant and appropriate requirements (ARARs) for the remediation of many CERCLA sites. The CAMU regulations require evaluation of seven decision criteria before designating a CAMU. As described in the box on the previous page, the ERDF will meet all CAMU decision criteria. In addition to meeting all of the substantive requirements of the seven CAMU criteria, the regulatory agency is required to specify certain information in its order, permit or remedy selection document relating to the physical and operational aspects of the CAMU. As described in the RI/FS and CAMU application, information sufficient to make these specifications is contained in the Regulatory Package. Since the ERDF meets the seven criteria and the necessary supporting information is available, designation of the ERDF as a CAMU is appropriate.

3) Long-term effectiveness and permanence: Long-term effectiveness was measured in terms of future risk to human health and the environment and qualitative assessments of reliability. Future risks are associated with soil exposure resulting from intrusion into the facility or exposure to groundwater impacted by migration of contaminants out of the facility. The risks provided below assume that all the waste in the ERDF is characterized by the maximum concentration detected in 100, 200, and 300 Area waste units and thus the results are conservatively biased.

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All of the alternatives (except the no-action alternative) include active institutional controls (e.g., fences, signs, patrols), passive controls (e.g., markers and off-site records), and a surface barrier that is at least 4.6 m (15 feet) thick. It is assumed that institutional controls prevent intrusion into the waste for at least 100 years and that passive controls prevent intrusion for 500 years. Furthermore, because the waste is covered with at least 4.6 m (15 ft) of cover materials, construction excavations are unlikely to extend into the waste. Since none of the evaluated barriers can prevent penetration by a drilling rig, however, it is possible that someone might inadvertently drill through the waste sometime after 500 years. Therefore, soil exposures for both human and ecological health are calculated assuming the 500-year drilling scenario.

Groundwater impacts were calculated assuming that an engineered barrier is constructed over the facility to minimize infiltration through the waste and maximize the travel time to groundwater. In addition, it was assumed that only waste meeting the allowable leachate concentration criteria (either with or without treatment) would be placed in the facility. For alternatives with liners, it was further assumed that all leachate was retained by the HDPE liner and removed by the leachate collection system for the first 30 years of operation. In addition, the added travel time associated with migration though the clay layer was accounted for in the analysis.

Long-Term Human Health Impacts. The human health risks associated with soil exposure resulting from the 500-year drilling scenario include a total ICR of 4×10^{-5} (dominated by uranium) and a maximum HQ of 0.03 (associated with copper). These risks are the same for all the alternatives (except the no-action alternative). The predicted HQ and ICR associated with the 500-yr drilling scenario are below the goals established in the Tri-Party Agreement of 1 for HQ and 1×10^{-4} for ICR.

For all the alternatives except no action, none of the contaminants are predicted to reach groundwater within 10,000 years under current climate conditions. Risks after 10,000 years are considered highly uncertain given the potential for climatic changes, geologic events, and human activities, and were not evaluated. Groundwater concentrations and associated risks were also predicted assuming that the rainfall rate increased from the current average for Hanford of 18 cm (7 in.) to 40 cm (16 in.) at 100 years. This scenario was intended to represent either a wetter climate or irrigation on top of the ERDF. Although the results of these analyses are intended to show potential effects associated with climate or land use changes, they should not be considered the most likely scenario. The increased rainfall rate resulted in contaminant travel times from the ERDF to groundwater that were as low as 150 years and the predicted risks ranged from $2x10^{-5}$ to $3x10^{-4}$ for ICR and 0.8 to 7 for HQ. Differences in the results were primarily due to differences in the type of barrier. Because leachate collection is assumed to last only 30 years and the rainfall rate was assumed to remain at current levels for the first 100 years, only minor differences in risks and travel times can be attributed to the liners. Since Alternatives 2, 3, and 4 only differ in terms of their liner, their residual risk should be considered essentially equal.

Long-Term Ecological Impacts. Ecological risk is expressed in terms of an environmental HQ (analogous to the human health HQ) for non-radionuclides and radiological dose for radionuclides. The maximum ecological health risks associated with soil exposure resulting from the 500-year drilling scenario include a total radiological dose of 0.6 rad/day (dominated by uranium) and an environmental HQ of 12 for copper. A dose of 1 rad/day is generally considered acceptable for ecological receptors. The remaining environmental HQs were less than 0.05. Note that the background concentration of copper in soil (28.2 mg/kg) results in an environmental HQ of 3, which has not resulted in adverse impact to the environment. Evidently, the environmental exposure analysis results in an overestimate of risk to environmental receptors and it is likely that the intrusion scenario will not result in adverse impacts to the environment. These risks are the same for all the alternatives (except no action).

Reliability. Alternatives 3 and 4, which include trench liners, offer several advantages over Alternative 2 (the no-liner alternative) in terms of reliability. The primary advantage is that any leachate generated during the operational period will be retained by the trench liner and pumped out. A secondary advantage of a liner/leachate collection system is that it allows characterization of the leachate generated in the waste. Knowledge of the leachate properties could be used to predict future impacts on groundwater once leachate collection terminates or the trench liner fails. This knowledge is useful because the liner is expected to fail relatively soon (perhaps within decades). The double composite liner offers a redundancy in leachate collection systems not available in the single composite liner. The potential for flaws in the primary liner is uncertain, although it is probably low given the high level of construction quality assurance planned for the ERDF. Furthermore, the rate of degradation of a double composite liner will probably be similar to the degradation rate for the single composite liner.

4) Reduction of Toxicity, Mobility, or Volume through Treatment: Specific treatment options will be evaluated in the RI/FSs for the source operable units.

5) Short-Term Effectiveness: Short-term effectiveness includes risks to workers and the public during implementation of an alternative, potential environmental impacts of the alternative, and time until protection is achieved.

Operation of the ERDF will involve potential releases of waste during transport and placement in the ERDF. Health risks for ERDF workers, other Hanford Site workers, and the public due to exposure to waste contaminants have been evaluated for a variety of conditions, including: normal operating conditions, a 24-hour period of high winds, and rupture of a waste container due to a transportation accident. In all cases, the potential health risks were considered low. Since the operation of the ERDF will be the same for all the alternative, these risks would be the same for all the alternatives. All the alternatives (except the no-action alternative) include safety measures (such as dust controls, surface water management, and emergency equipment) to minimize risks during construction and operation of ERDF.

Environmental impacts associated with construction and operation of the ERDF will occur at the ERDF, along the new rail spur, and at any quarry sites for barrier materials. These impacts will include destruction of habitat, displacement of wildlife at these areas, and disturbance of wildlife near these areas due to noise and human activities. Since none of the liners included in the alternatives will utilize any on-site materials, the environmental impacts will be the same for all the alternatives (except the no-action alternative). DOE (in cooperation with the State of Washington Department of Fish and Wildlife and the U.S. Fish and Wildlife Service) is currently developing a Hanford Site-wide biological resources management plan for mitigating these environmental impacts.

The time until remediation is achieved will depend on the rate that waste is delivered to the ERDF and will be the same for all the alternatives (except the no-action alternative).

6) Implementability: The factors included under this criterion include technical implementability, availability of materials and services, and administrative implementability.

Technical implementability is determined by the complexity of the design. Since barrier design is not specified in the proposed plan, the implementability of the alternatives is determined by the complexity of the liner. Alternative 2, which does not include a liner or leachate collection and treatment, will be the easiest to construct. Alternatives 3 and 4 include the same type of leachate collection and treatment system and the types of materials included in the two different liners are the same. However, the secondary liner/leachate collection system in the double liner will increase the complexity of the design for Alternative 4.

All the materials and services for construction of the liners are readily available from off-Hanford Site venders and their availability is not expected to pose any implementability problems. Some materials included in the barrier designs (silt and crushed basalt) will come from sources on the Hanford Site and concern has been raised regarding development of potential sources. In particular, cultural resources have been identified at McGee Ranch, the proposed source of silt, that will likely require mitigation before the site may be developed. In addition, basalt outcrops on the Hanford Site have religious significance to Native

American tribes and development of a basalt source would require consideration of these cultural values.

None of the alternatives require transport, treatment, or disposal of waste off the Hanford Site. Since CERCLA excludes administrative requirements of ARARs for on-site actions, no permits will be necessary and no administrative difficulties are anticipated.

7) Cost: Common costs for the three ERDF alternatives are summarized below:

Common Costs

Type	Cost (millions)
Support Facilities	$75
Permitting and Design	$22
Trench Excavation	$109
Operational Cost (over 25 years) (Net Present Value)	$500 ($255 present worth)
Total Common Costs (Net Present Value)	$460

The net present values are calculated assuming a 6 percent discount rate. Liner costs (including leachate collection system) are summarized below. The total net present value for each alternative, including common costs, liner costs, and barrier costs, are also provided below. The barrier costs are estimated to range from $53 million to $373 million depending on the type of barrier. Assuming that the barrier is constructed 20 years in the future, the net present value for the barrier ranges from $40 to $280 million. Costs provided below assume that the Hanford Barrier is constructed over the facility at a net present value of $280 million.

Alternative Cost

Alternative	Liner Costs (millions)	Total Costs (millions)
2: No Liner	$0	$740
3: Single Liner	$85	$825
4: Double Liner	$178	$918

8) State acceptance: The Washington Department of Ecology has reviewed the RI/FS and the proposed plan and their comments have been resolved and incorporated in the final versions.

9) Community acceptance: Assessment of this criterion may not be completed until comments on the proposed plan are received. Public comments will be considered in remedy selection for the record of decision.

SUMMARY OF THE PROPOSED ALTERNATIVE

The proposed alternative is Alternative 4 (a double lined trench with a barrier that protects groundwater and minimizes the potential for direct contact with the waste). This alternative provides the greatest long-term effectiveness and reliability. Although the results provided above suggest that a trench liner may not provide significant benefits (given an effective infiltration surface barrier), it may provide some measure of redundancy and allow confirmation of leachate generation rates and quality. As information is obtained regarding the quantity and quality of leachate, the need for a double liner may be further evaluated. If the evidence indicates that a single liner or no liner will provide sufficient protection of human health and the environment, then revision of the Record of Decision (ROD) may be considered. Any significant changes in the liner design that appear warranted would be carried out only after completion of the full public participation process required under CERCLA.

As discussed previously, although the facility barrier will be designed to limit infiltration, deter intrusion, and minimize releases, a specific design has not been finalized in this proposed plan. Research in the area of barrier performance is currently ongoing and it was determined that a better evaluation of the barrier alternatives could be conducted as results of the research are available. Furthermore, since barrier construction will not commence for a number of years, it would be inappropriate to select the barrier design until this information is available. Until that evaluation can be completed, however, the CAMU application will assume that a RCRA-compliant barrier will be constructed over the ERDF. Decisions regarding barrier design and construction would be subject to the full public participation process.

The public is encouraged to provide comments on this plan and examine all the alternatives considered during the RI/FS for the ERDF. The recommendations provided herein are preliminary and will be finalized once all public comments have been adequately addressed.

GLOSSARY

Dangerous/hazardous waste: Dangerous waste is regulated by the Washington Department of Ecology pursuant to the federal hazardous waste regulations. Hazardous waste is the term used in the Federal regulations under RCRA.

Fate and transport modeling: A mathematical process for simulating the behavior of contaminants in various environments to predict contaminant concentration and mobility. Models range from simple analytical solutions to complex numerical models.

Health-based criteria: Limits on concentrations of contaminants that are developed based on the possible adverse affects on human health, including both carcinogenic affects (measured by the incremental cancer risk) and non-carcinogenic affects (measured by the hazard quotient).

Infiltration: Movement of water through the ground surface and beyond the rooting depth of plants. Any water that moves past the rooting depth is likely to eventual migrate to the water table.

In-situ treatment and/or containment: The treatment and/or isolation of waste in the original location (without removal).

Institutional controls: Rules, regulations, or laws that restrict access to a site, or use of the natural resources, in order to protect public health and/or the environment.

Leachate: The solution formed by the dissolving of waste constituents by infiltration water.

Sensitive species: Species of plant or wildlife that is included on the list of sensitive species or is under review by the state or federal government for possible listing as sensitive. A sensitive species is considered vulnerable or declining and is likely to become endangered or threatened without proper management.

Permeability: The capability of a substance to transmit liquid or gas through its pores.

Net present value: The value or cost of a project, including future costs, in terms of today's dollars.

Receptor: Organisms that may be potentially exposed to contaminants.

Solid waste: Municipal garbage, construction or demolition materials, and/or industrial wastes that are not liquids or are stored in solid containers.

Waste unit: Area or waste facility requiring remediation.

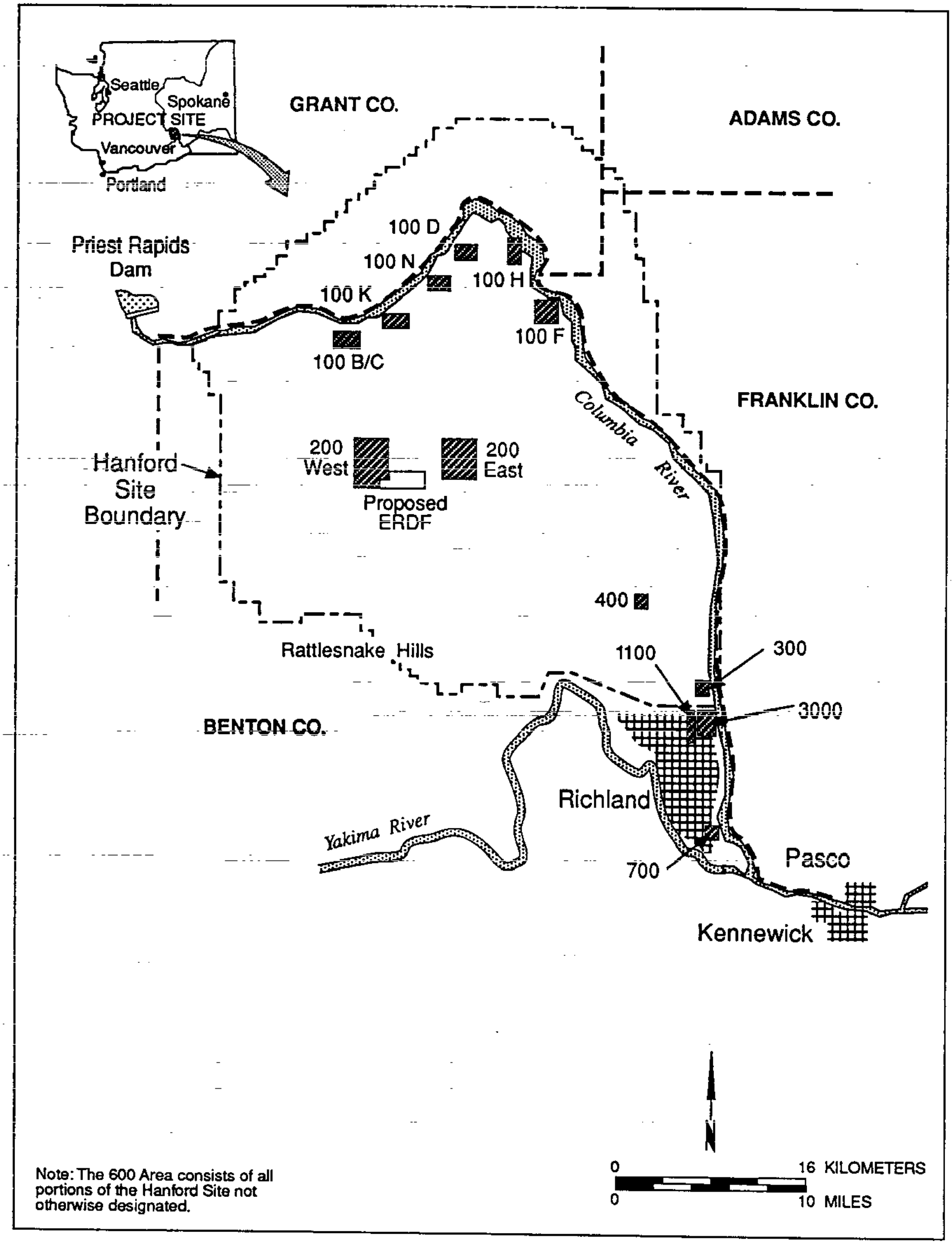

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Figure 1. Hanford Site Map.

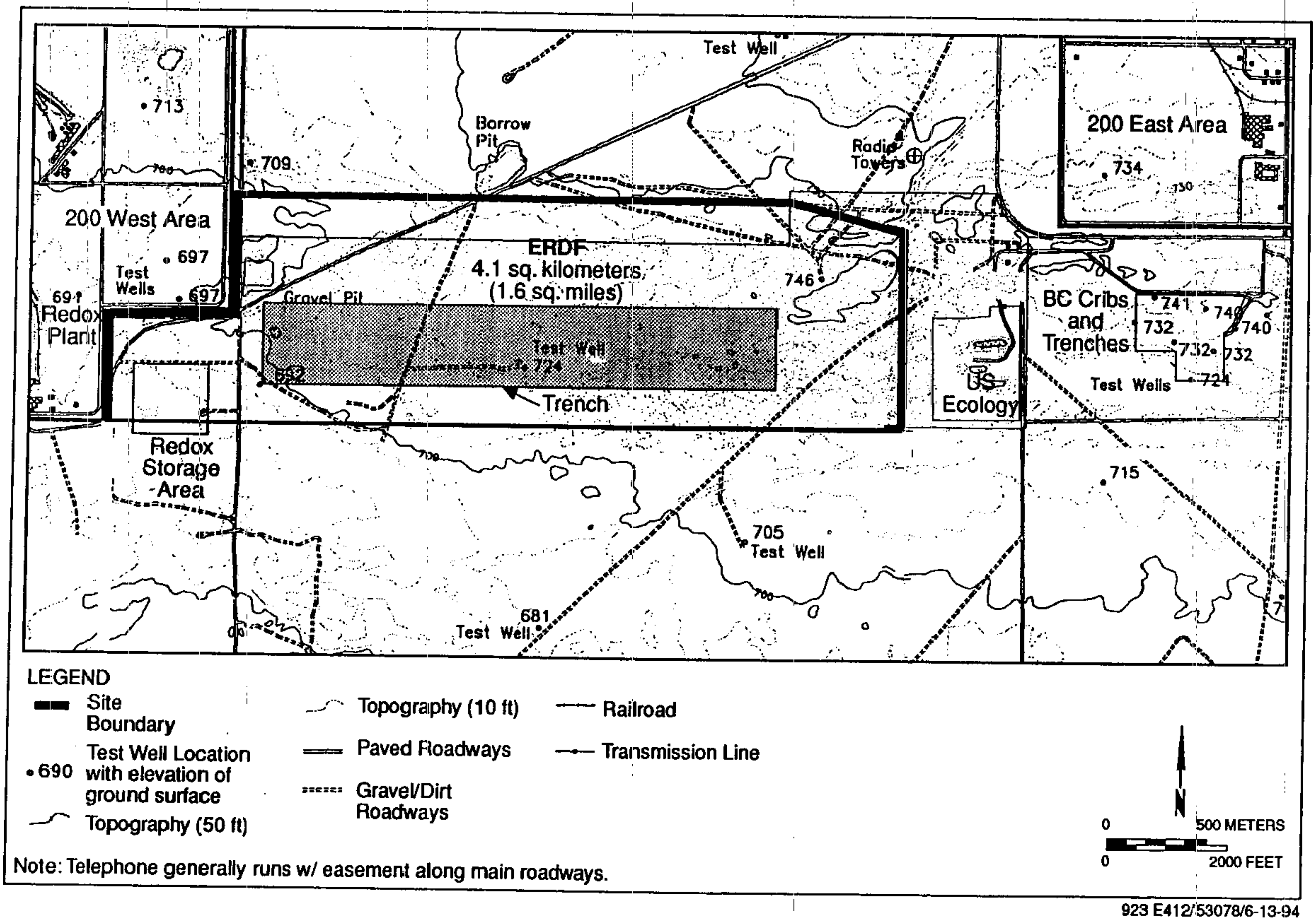

Figure 2. Location of the ERDF.

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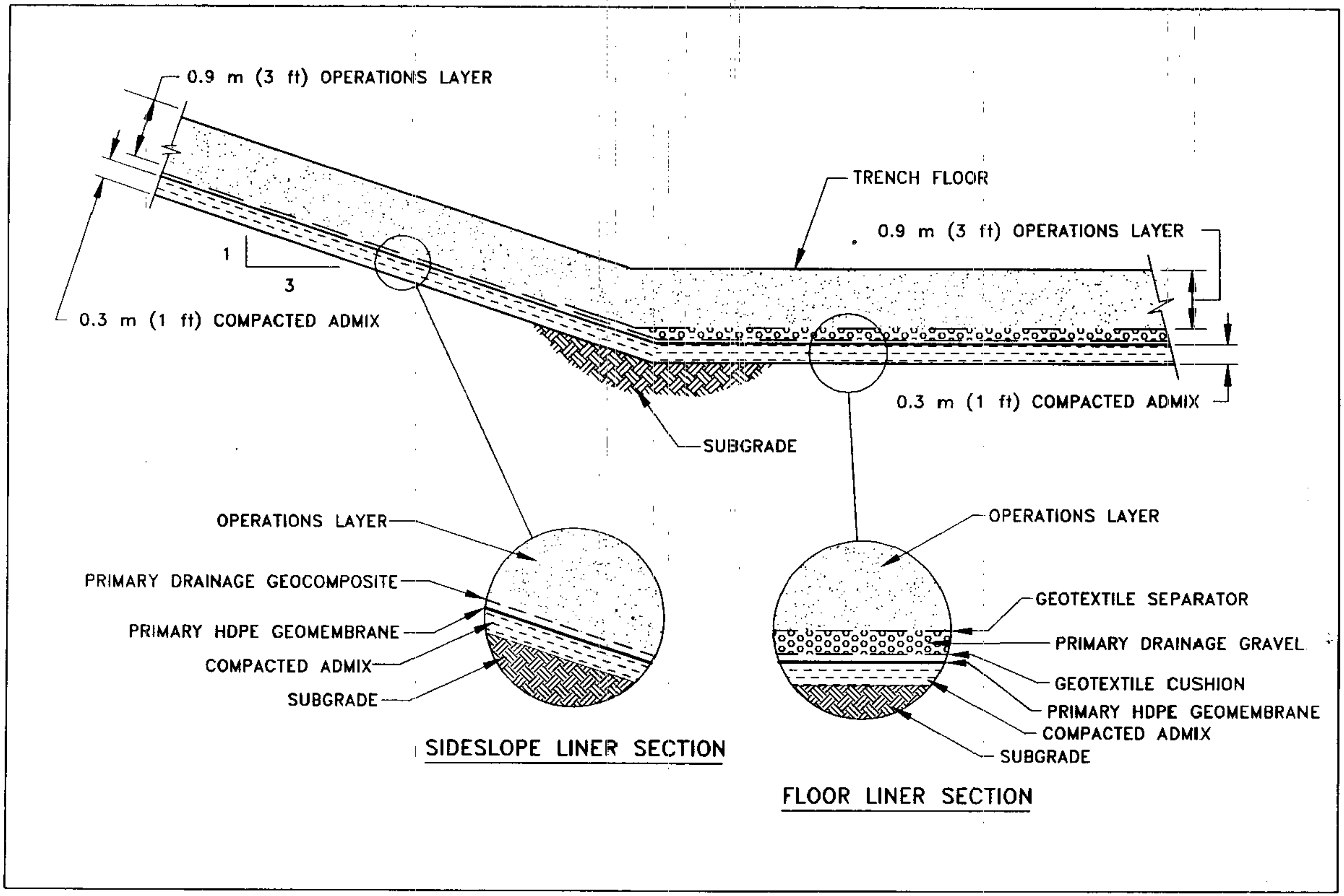

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Figure 3. Cross Section of a Single Liner System.

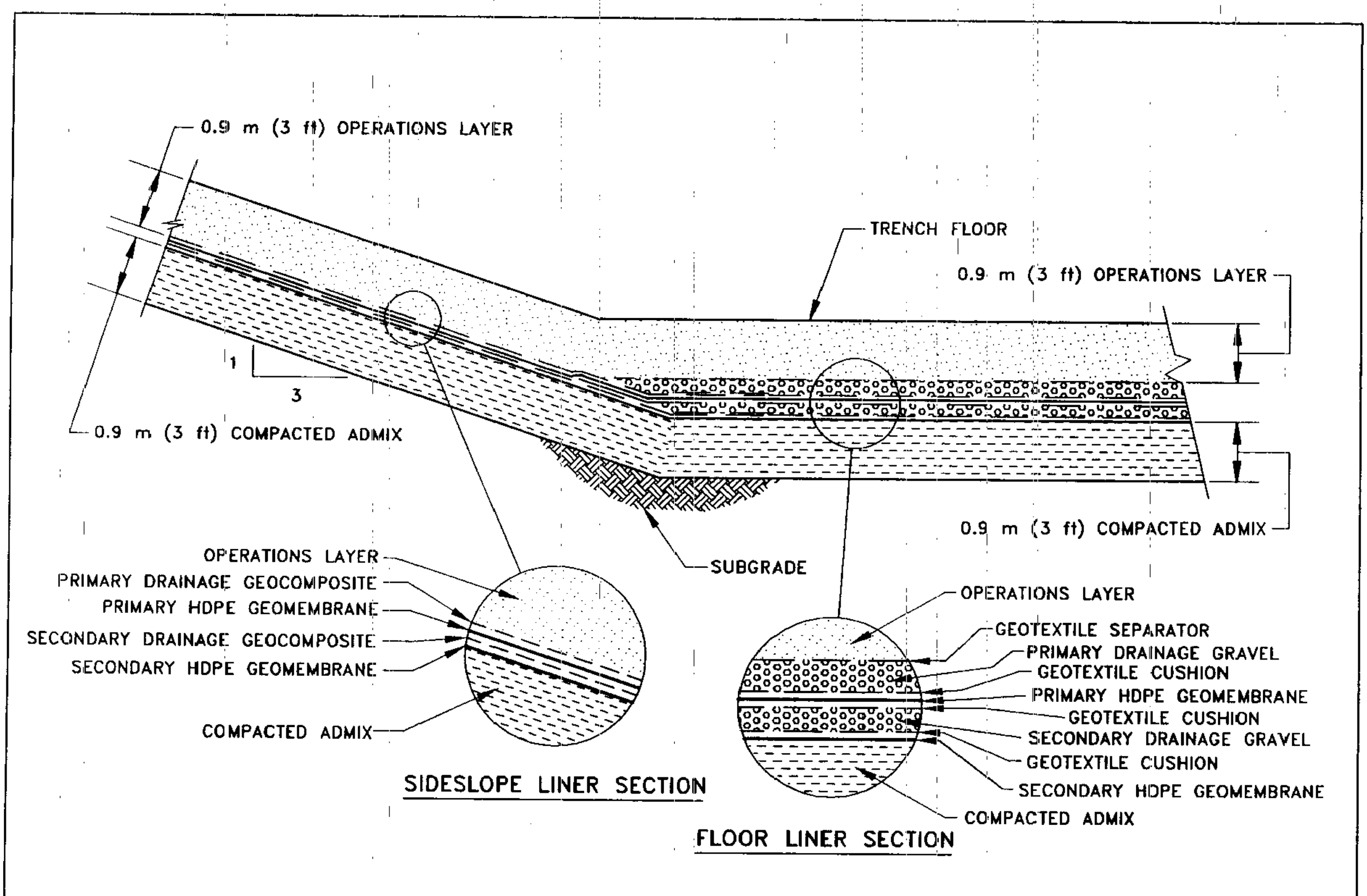

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Figure 4. Cross Section of a Typical RCRA Subtitle C Double Liner System.

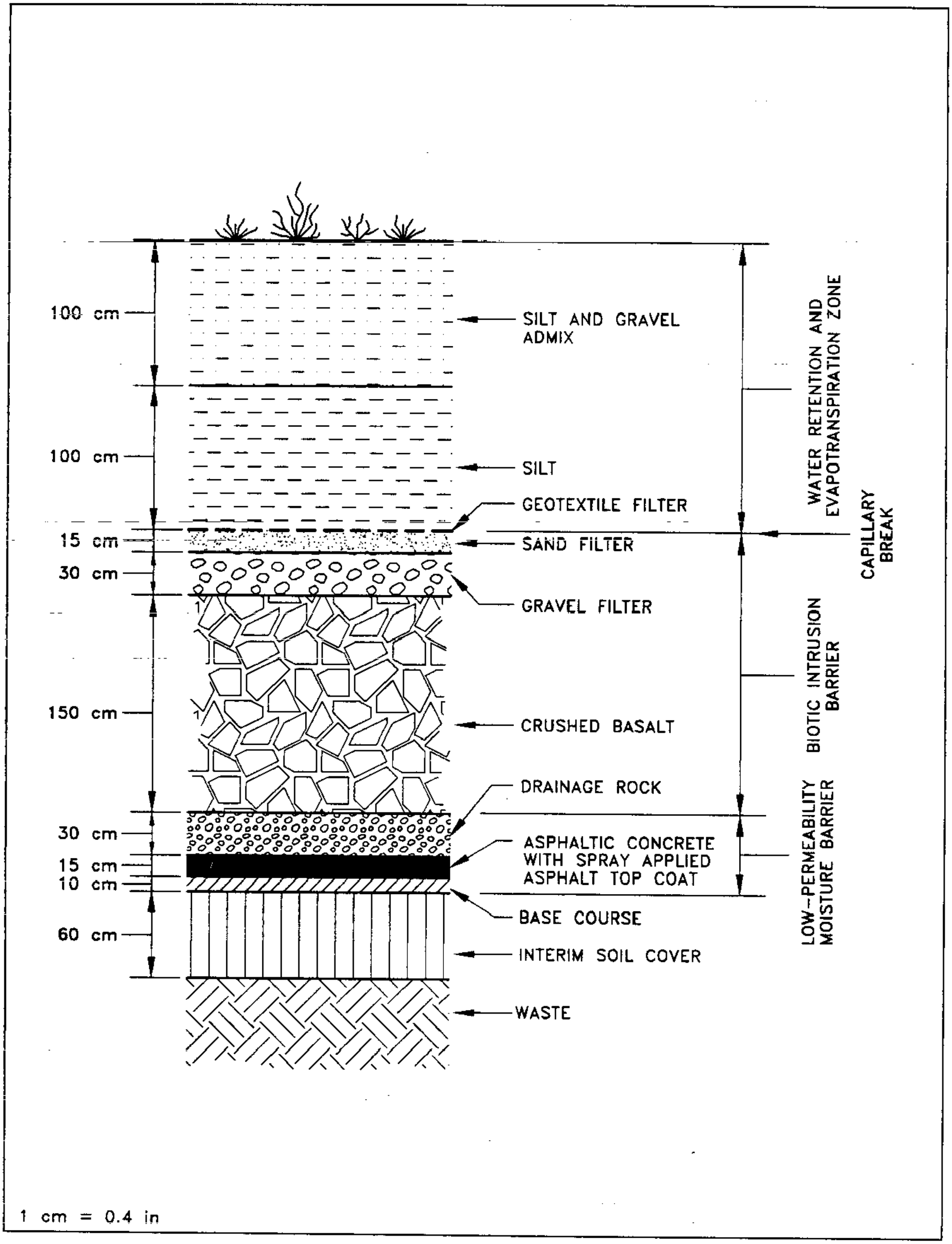

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Figure 5. Cross Section of the Hanford Barrier.

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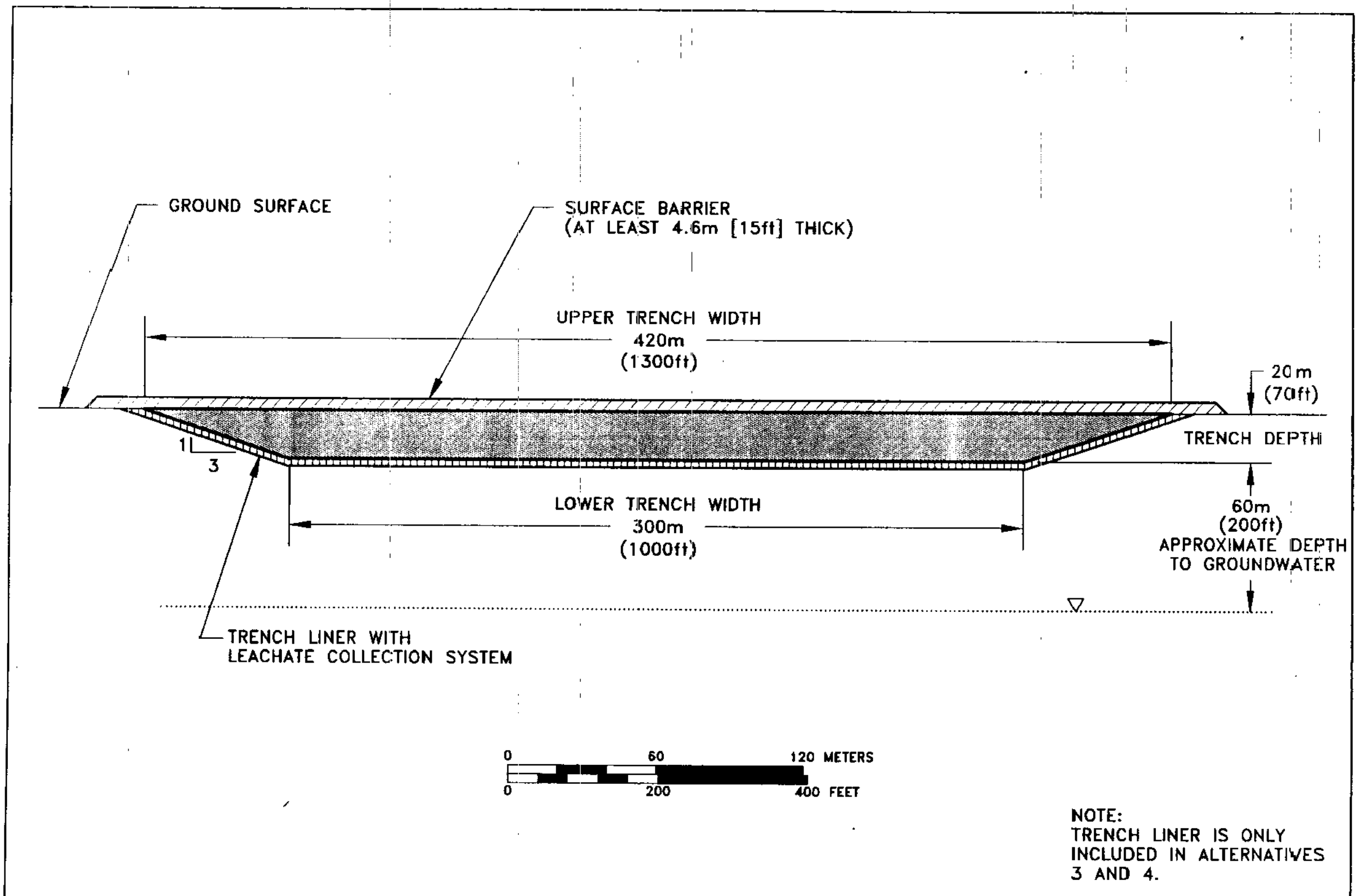

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Figure 6. Cross-Sectional Dimensions for ERDF Trench.

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